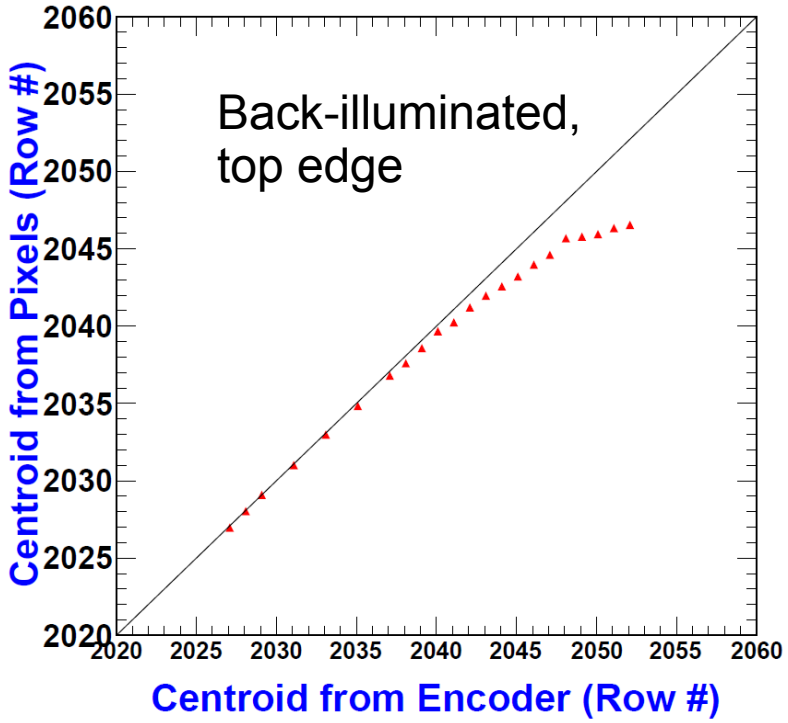
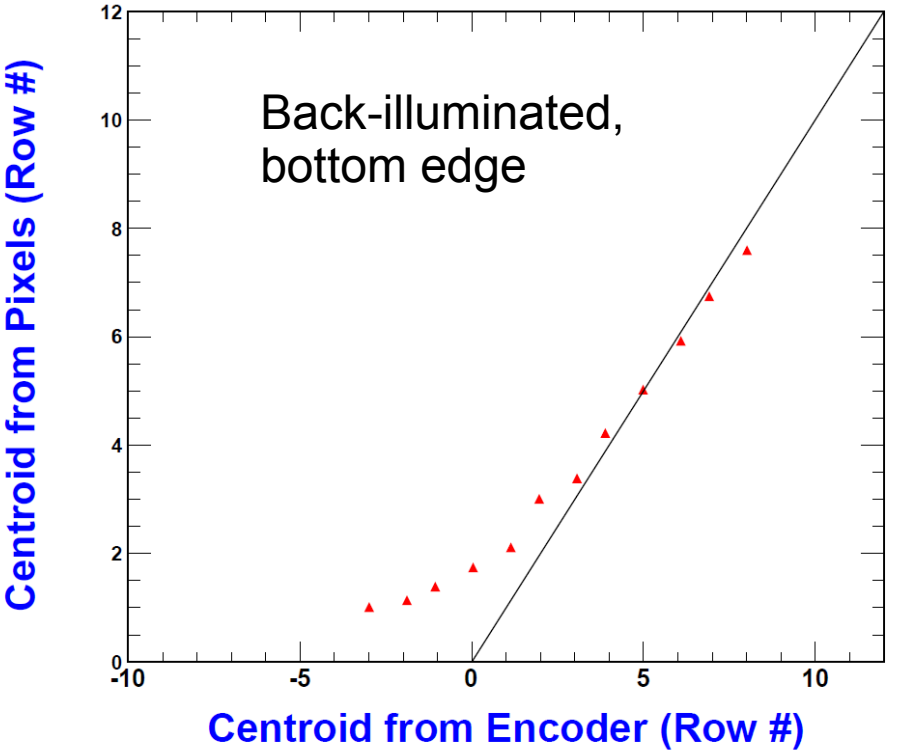
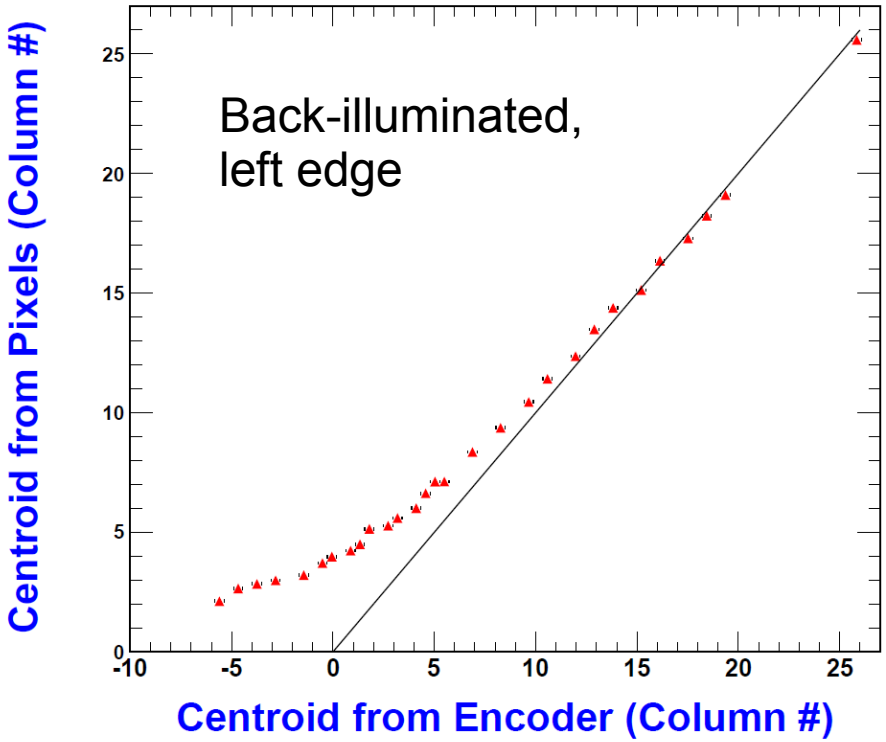
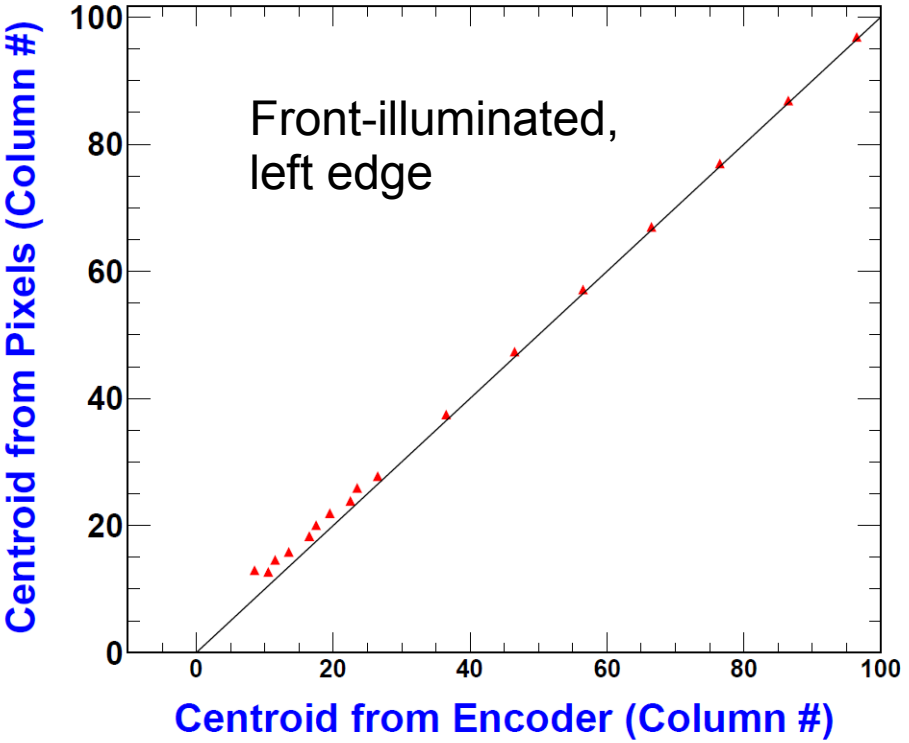
Steve Holland, numero uno CCD engineer at LBNL, will be giving the noon detector seminar at ANL, Thursday, April 23rd.

Will try to schedule a private meeting, next 2 slides are what I plan to show him...

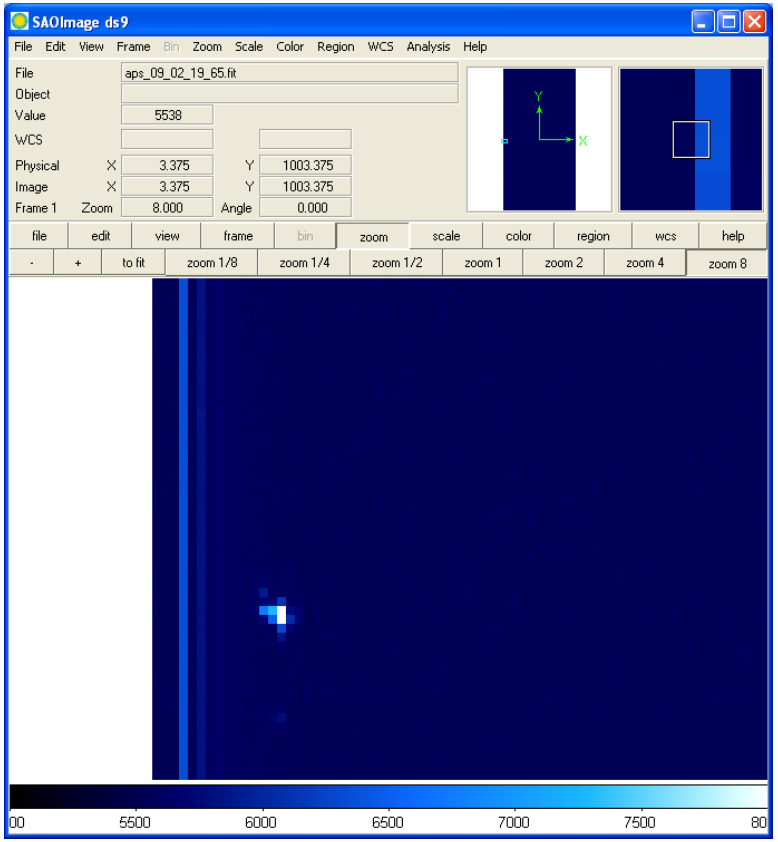

Back-illuminated,
top edge
Centroid from Pixels (Row #)
Centroid from Encoder (Row #)
2020
2025
2030
2035
2040
2045
2050
2055
2060


Back-illuminated,
bottom edge
Centroid from Pixels (Row #)
Centroid from Encoder (Row #)
-10
-5
0
5
10
0
2
4
6
8
10
12

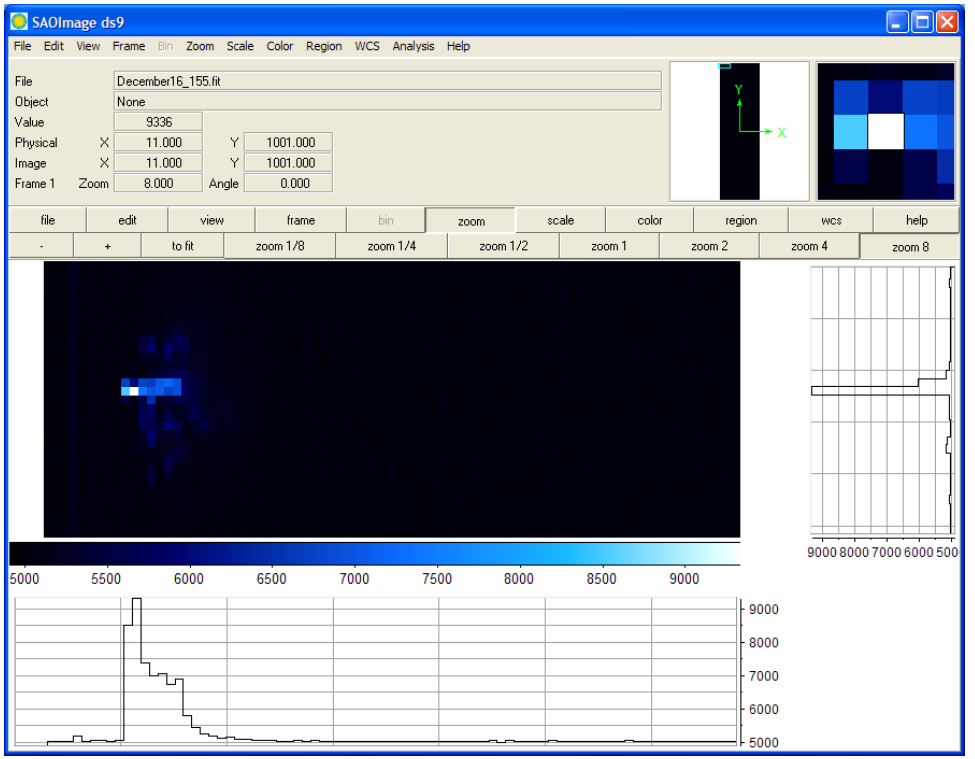

Back-illuminated,
left edge
Centroid from Pixels (Column #)
Centroid from Encoder (Column #)
-10
-5
0
5
10
15
20
25


Front-illuminated,
left edge
Centroid from Pixels (Column #)
Centroid from Encoder (Column #)
0
20
40
60
80
100

Back-illuminated,
left edge

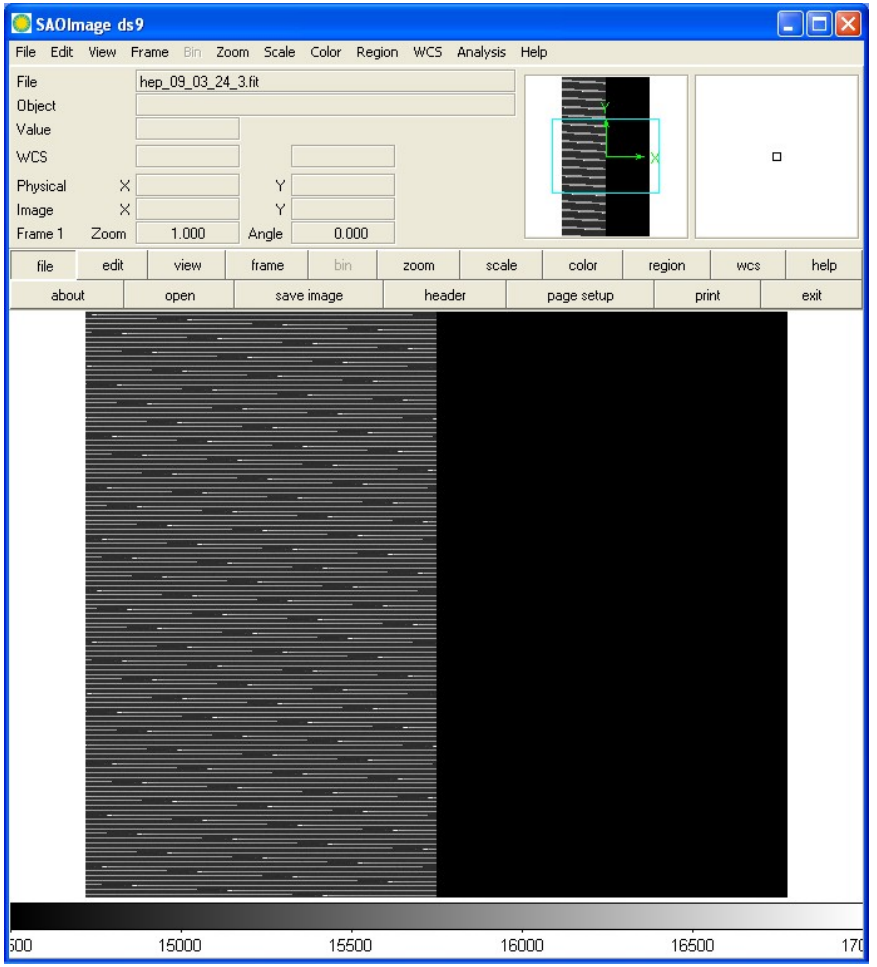


Front-illuminated,
left edge



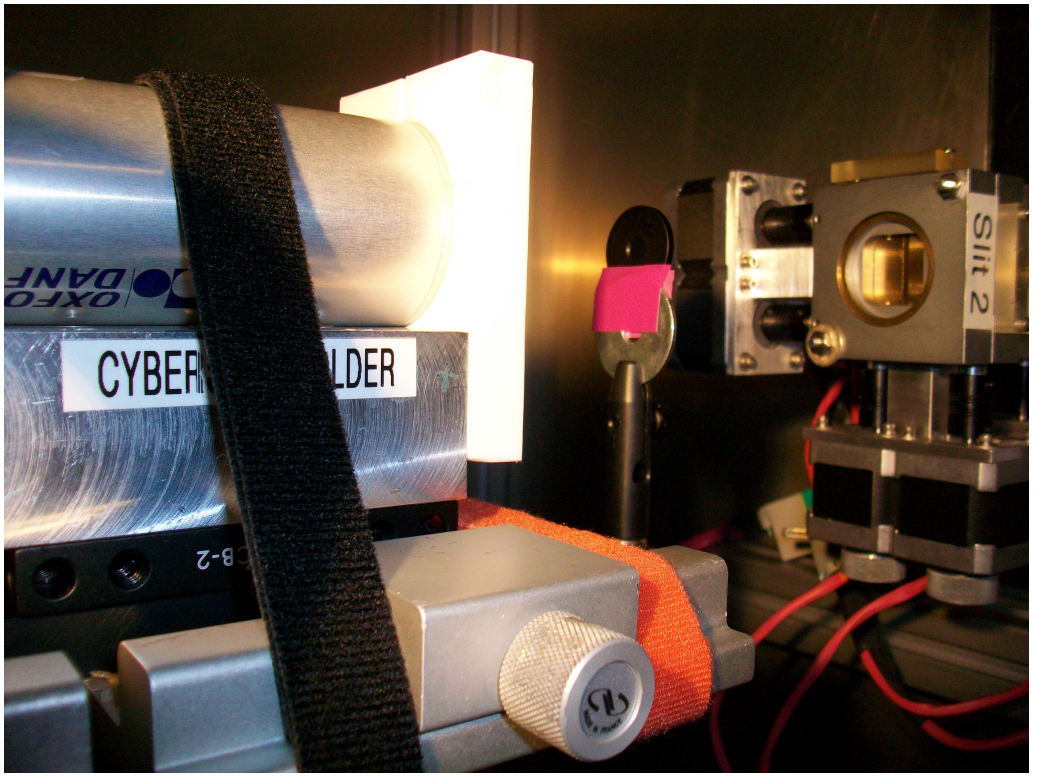
Plan is to go back to APS with new front-illuminated CCD, and hopefully with a smaller beam

Received 6 CCDs from FNAL with unknown status, 5 are front-illuminated, first one tested looks funny



APS News

- Pinhole studies by Rich and Hal
- Continuation with <300um slit opening
- 2 Pinhole Plan?



APS News

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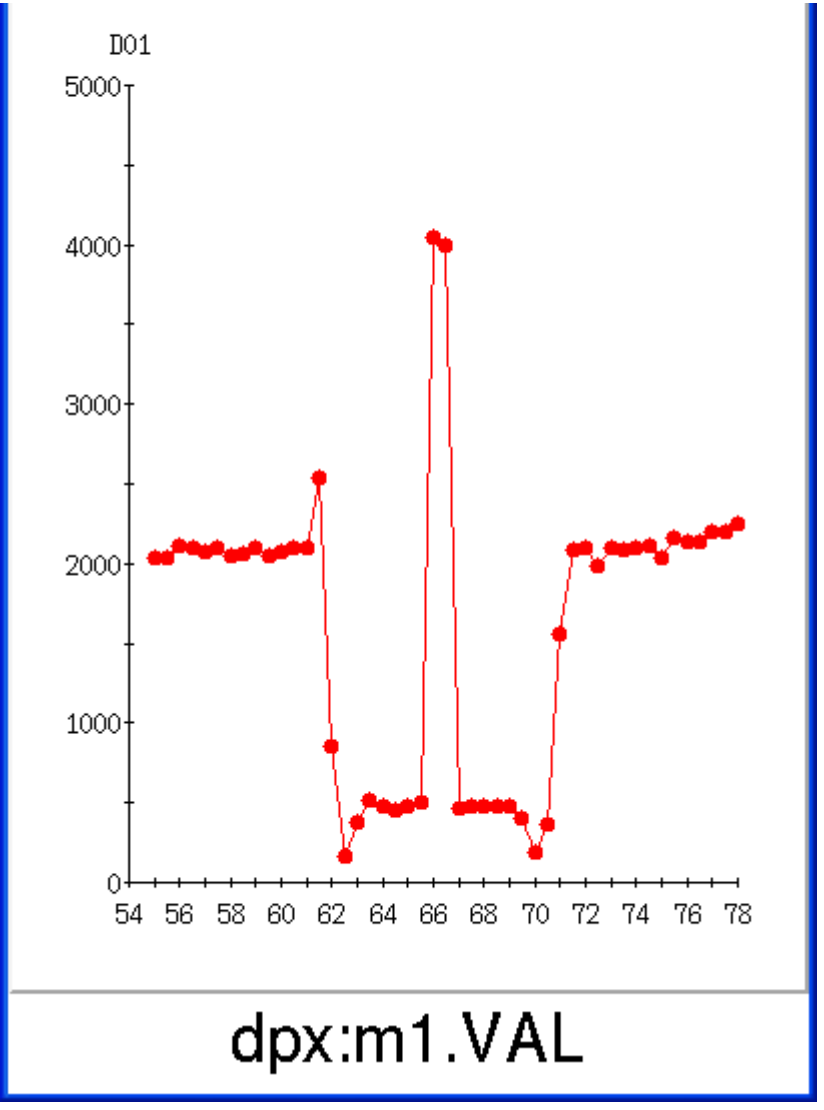
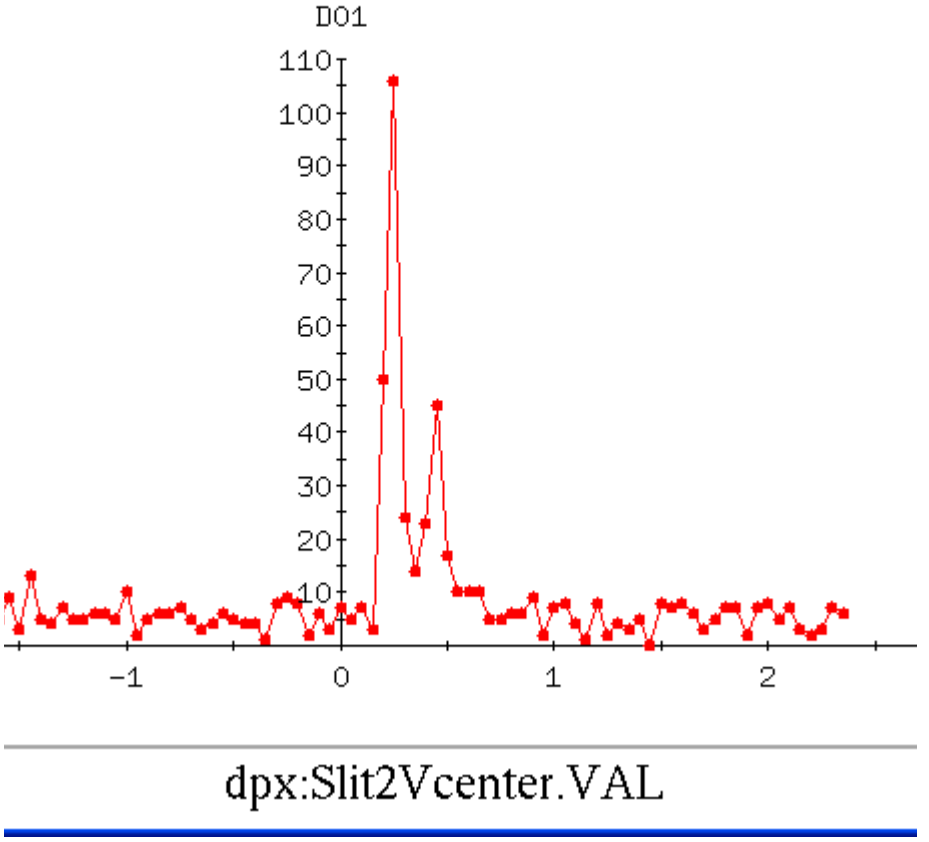




3 options (?): 1) talk to Tim Graber about APS beamline 5um capability
2) 1 pinhole fixed, 2nd on xy-stage (hard to reproduce)
3) make tube for both pinholes (hard to point to beam spot)

Pinhole 1 radius	Pinhole 2 radius	Distance Pinhole 1 to CCD	Image radius on CCD
10um	2.5um	15 cm	6um
15um	2.5um	20 cm	6um
30um	5um	30 cm	7um

The Detroit Area Schools Supernova Search

26 Mar 2009

Adam Lincoln
David Cinabro
Matt Taylor
Nick Davis

Wayne State University
Dept. of Physics and Astronomy

DASSS: program overview

- Provide equipment to participating schools
  - 8 or 12 inch telescope, computerized mount, CCD
- Schools commit to weekly observation sessions for DASSS, but otherwise free to use equipment

- Once a week or so, a school takes images of about 10 assigned galaxies.
  - Each school pulls the target information from central website.

SK Comment: Based on discussion at meeting, this looked doomed to failure, will give up before seeing a SN. Seems much better to get to ~16 magnitude sensitivity and do SN follow-up based on IAU notification.

12”, ~$7K

(14” is ~$9K)

16”, ~$17K

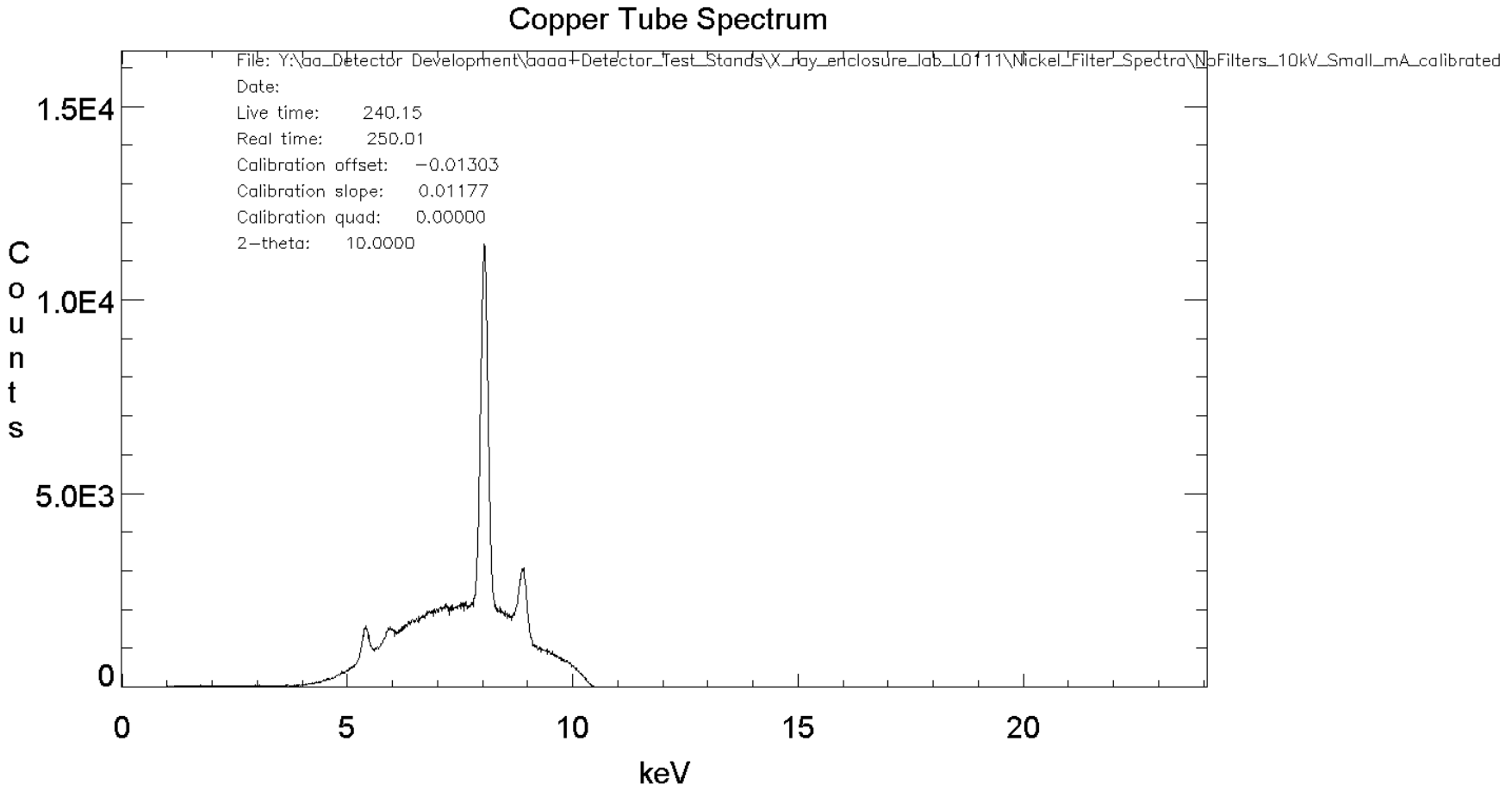
12” can get to 11.6 mag in 2 minutes, and 16” can get to 10.8 mag in 20 seconds (stars).

11.6 = Zeropoint12” + 2.5*log10(120s) Zeropoint12” = 6.4
Mag = 6.4 + 2.5*log10(3600s) = **15.3**

10.8 = Zeropoint16” + 2.5*log10(20s) Zeropoint16” = 7.6
Mag = 7.6 + 2.5*log10(3600s) = **16.5**

M51 taken with 16” and 3 filters

backup...


Copper Tube Spectrum
File: Y:\aa_Detector Development\aaaa+Detector_Test_Stands\X_ray_enclosure_lab_L0111\Nickel_Filter_Spectra\NoFilters_10kV_Small_mA_calibrated
Date:
Live time: 240.15
Real time: 250.01
Calibration offset: -0.01303
Calibration slope: 0.01177
Calibration quad: 0.00000
2-theta: 10.0000
Counts
1.5E4
1.0E4
5.0E3
0
0
5
10
15
20
keV

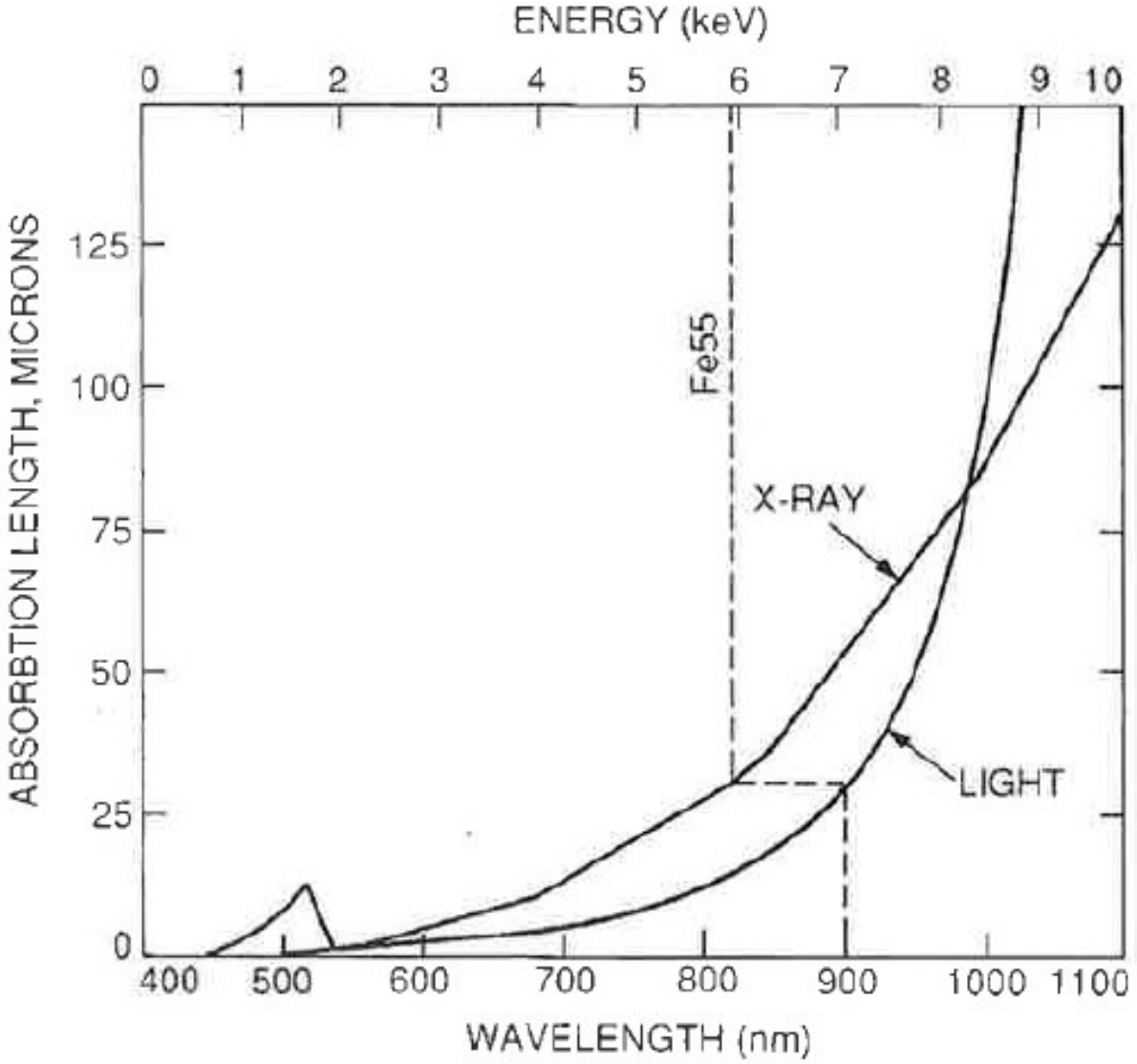
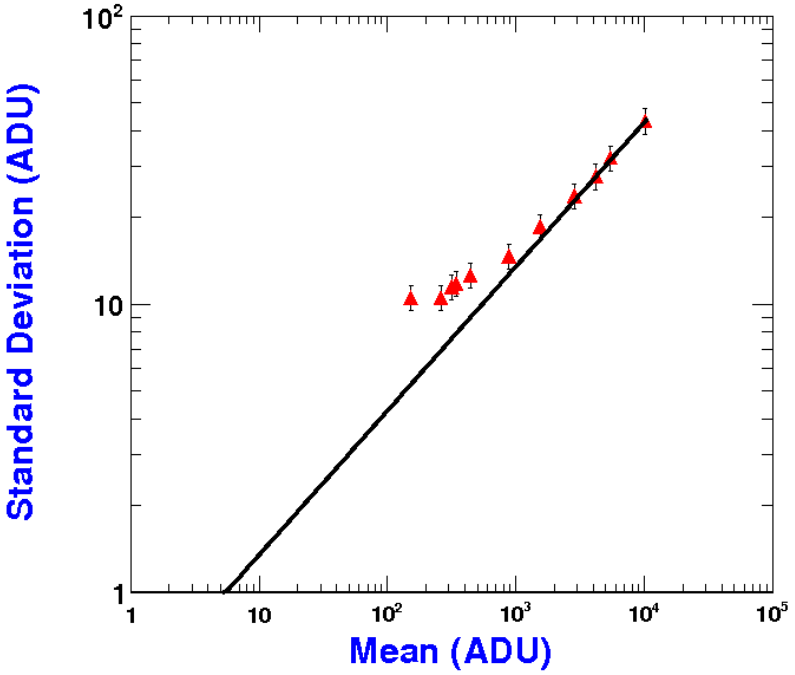
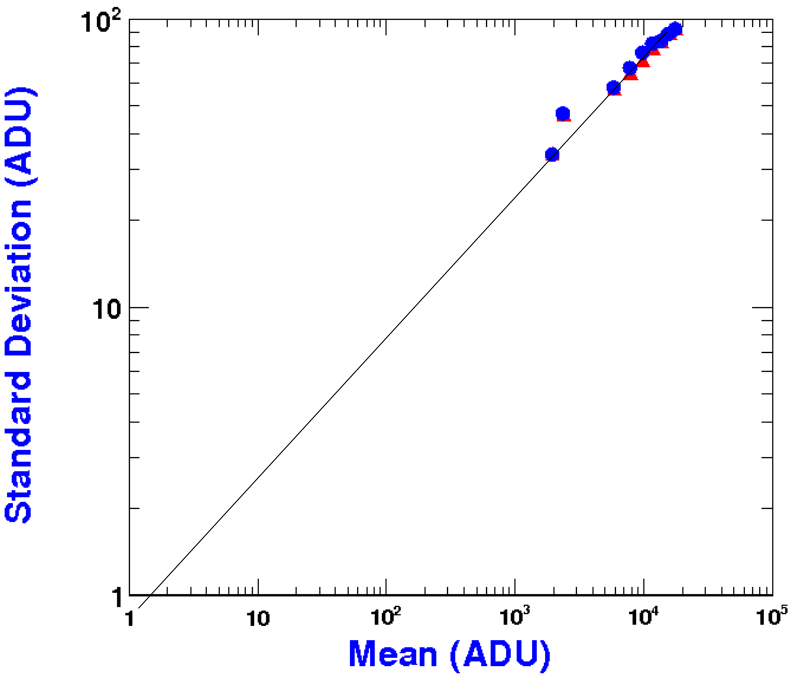


Figure 2.19 X-ray absorption length compared to visible and near-IR photons.

Front-illuminated



Back-illuminated,
red=600nm, blue=900nm

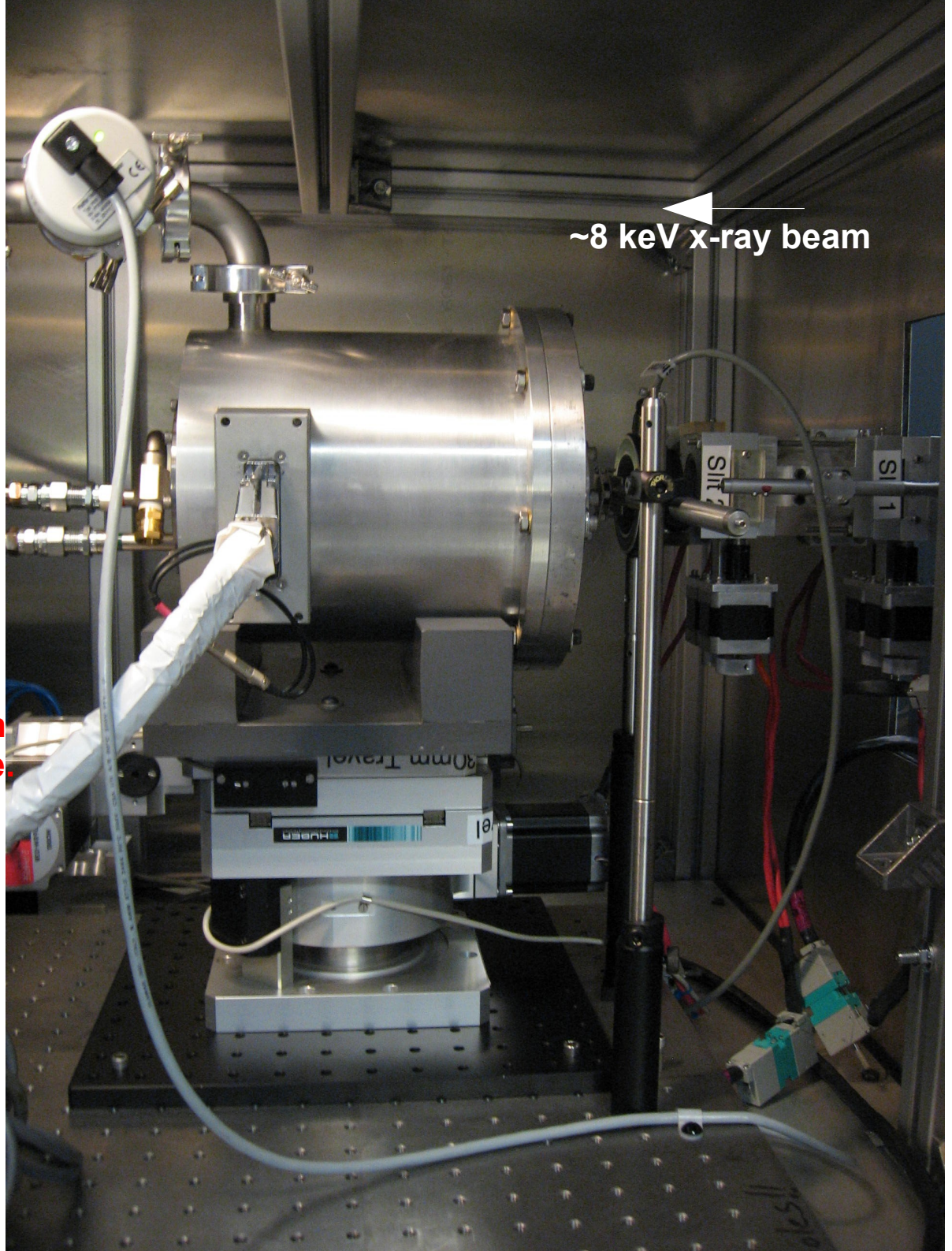


ANL/HEP test-stand at APS x-ray lab.

Using x-ray tube plus 5 μm tungsten pinhole.

Energy range of x-rays gives similar absorption lengths as optical range. (Janesick).

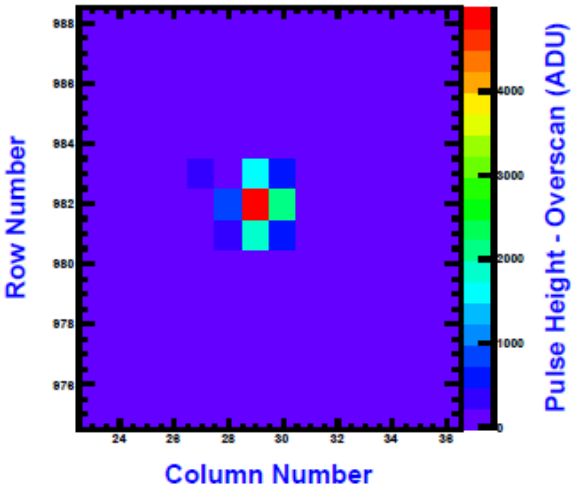
Sub-micron stepping motors move test-stand w/o disturbing beam.

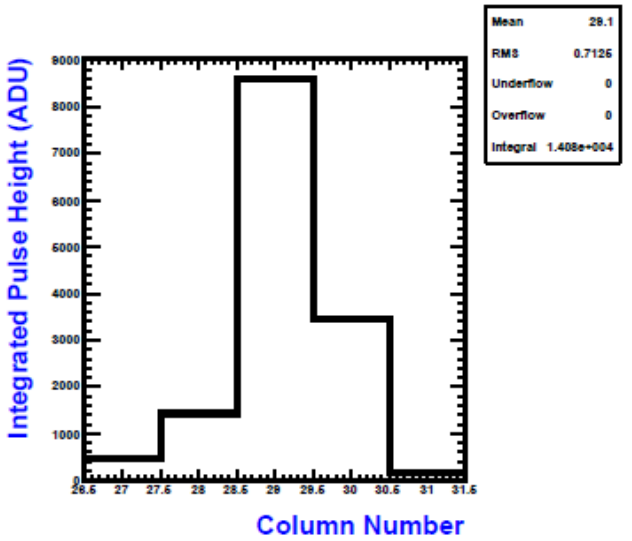


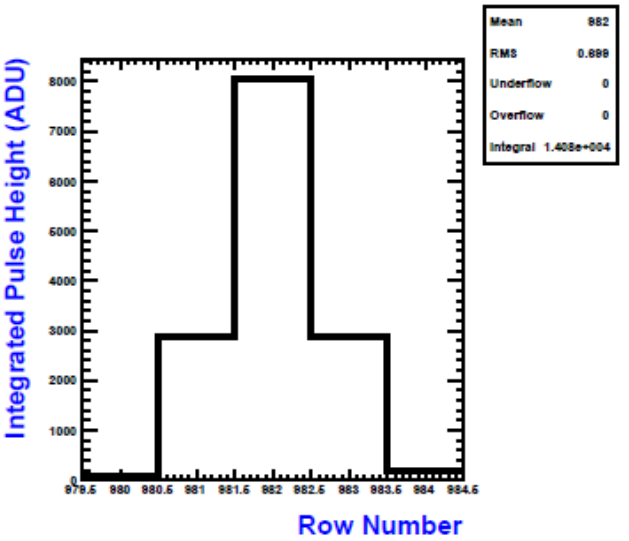
CCD News

- **Ordered 5 new pinholes (20,50,100,200,300 um) to help make sense of APS beamline, hope to put on motorized mounts**

- **Should get new front-illuminated CCDs from FNAL within a week, but need to test in HEP first.**


Row Number
Column Number
Pulse Height - Overscan (ADU)


Integrated Pulse Height (ADU)
Column Number
Mean 28.1
RMS 0.7126
Underflow 0
Overflow 0
Integral 1.408e+004


Integrated Pulse Height (ADU)
Row Number
Mean 882
RMS 0.899
Underflow 0
Overflow 0
Integral 1.408e+004

SN 60

X-ray tube with standard focus
focus size: 1 mm x 10 mm

Anode material	Tube output	Requis.-No.
Cu	2000 W	1900
W	2400 W	1901
Mo	2400 W	1902
Cr	1800 W	1903
Co	1800 W	1904
Fe	1500 W	1905
Ag	2000 W	1906

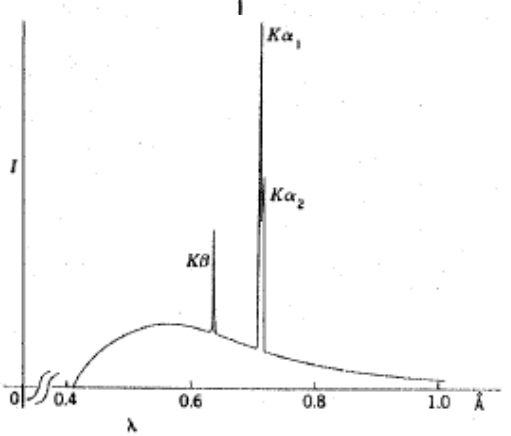
SF 60

X-ray tube with fine focus
focus size: 0.4 mm x 8.0 mm

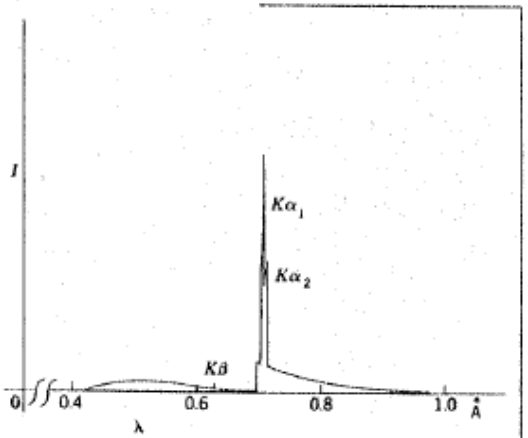
Anode material	Tube output	Requis.-No.
Cu	1500 W	1907
W	2000 W	1908
Mo	2000 W	1909
Cr	1300 W	1910
Co	1200 W	1911
Fe	900 W	1912
Ag	1500 W	1913

Technical Data

Tube voltage:	maximum 60 kV
Anode angle:	zero degrees
Focus size at a radiation angle of 6°:	
SN 60	Point focus
	1.0 mm x 1.0 mm
	Line focus
	0.1 mm x 10.0 mm
SF 60	Point focus
	0.4 mm x 0.8 mm
	Line focus
	0.04 mm x 8.0 mm
Inherent filtration:	0.4 mm Be
Filament current:	maximum 3.8 amps (at approx. 10 V)
Weight (SN 60 and SF 60):	short anode 1.6 kilos long anode 2.0 kilos
Cooling system:	Water circulation
Cooling water requirement:	minimum 3.5 liters/min
Water intake temperature:	maximum 35° C



Intensity distribution of the radiation of an X-ray tube without filter

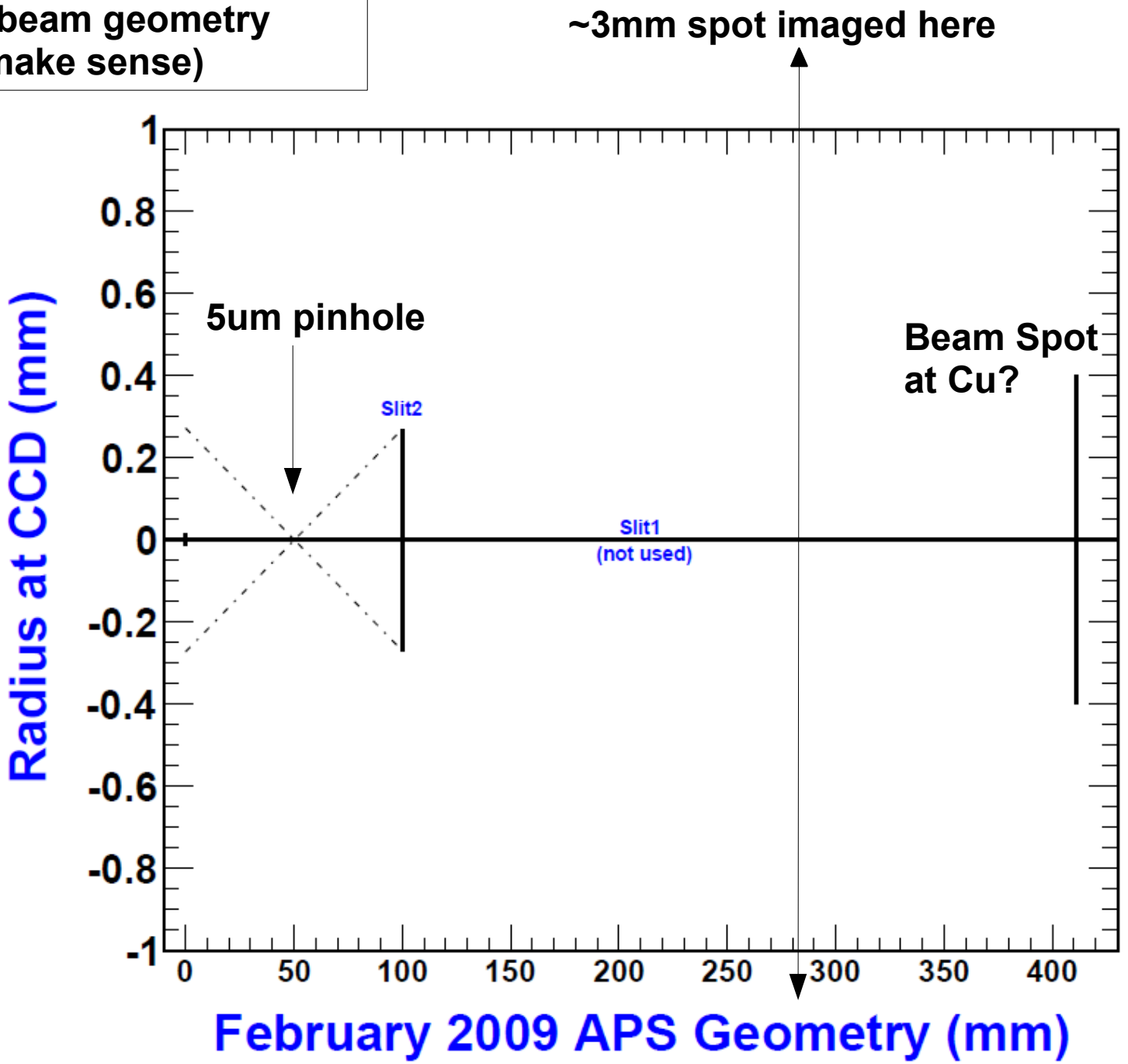


Intensity distribution of the radiation of an X-ray tube with filter

Anode	Exciting voltage (kV)	Energy $K\alpha_1$ (keV)	$K\alpha_1$ in Å	$K\alpha_2$ in Å	$K\bar{\alpha}$ in Å	$K\beta_1$ in Å	Beta Filter
Cr	6.00	5.41	2.28975	2.293660	2.2911	2.08492	V
Fe	7.11	6.40	1.936087	1.940025	1.9374	1.75665	Mn
Co	7.71	6.93	1.789007	1.792892	1.7903	1.62083	Fe
Cu	8.98	8.05	1.540598	1.544426	1.5418	1.392251	Ni
Mo	20.00	17.48	0.7093165	0.713607	0.7107	0.632303	Zr
Ag	25.52	22.16	0.5594205	0.563811	0.5609	0.497081	Rh
W_K	(69.51)	59.31	—	—	—	—	—
L	(12.09)	8.40	1.4765	1.4875	—	1.2815	—

Taken from: Int. Tab. of X-Ray Crystallography, Vol. IV, 1974
modified as with NBS, acc. to DESLATES, R. D., and HENIUS, A. (1973). Phys. Rev. Lett. 31, 972

Illustration of beam geometry (that doesn't make sense)

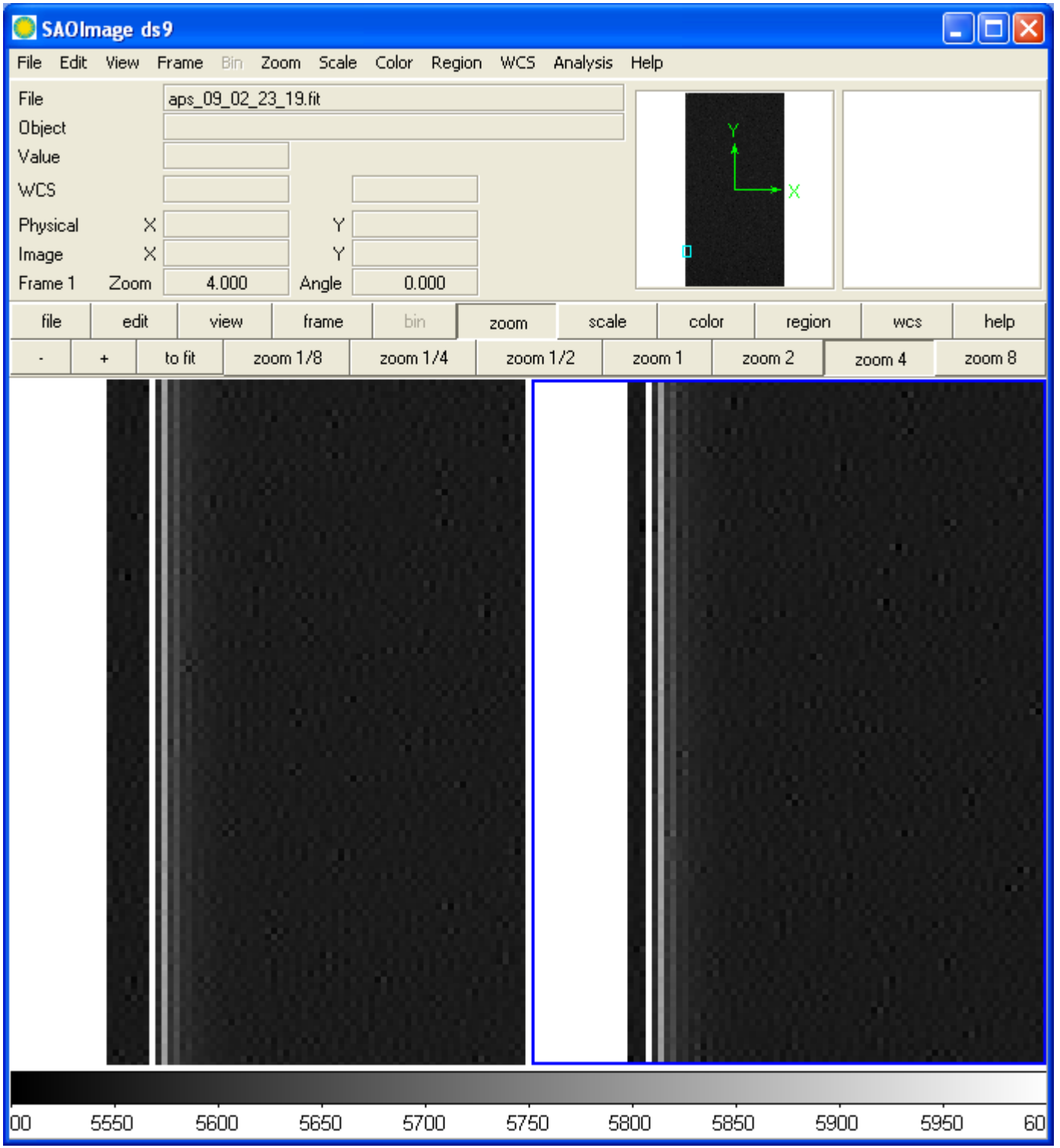


CCD News

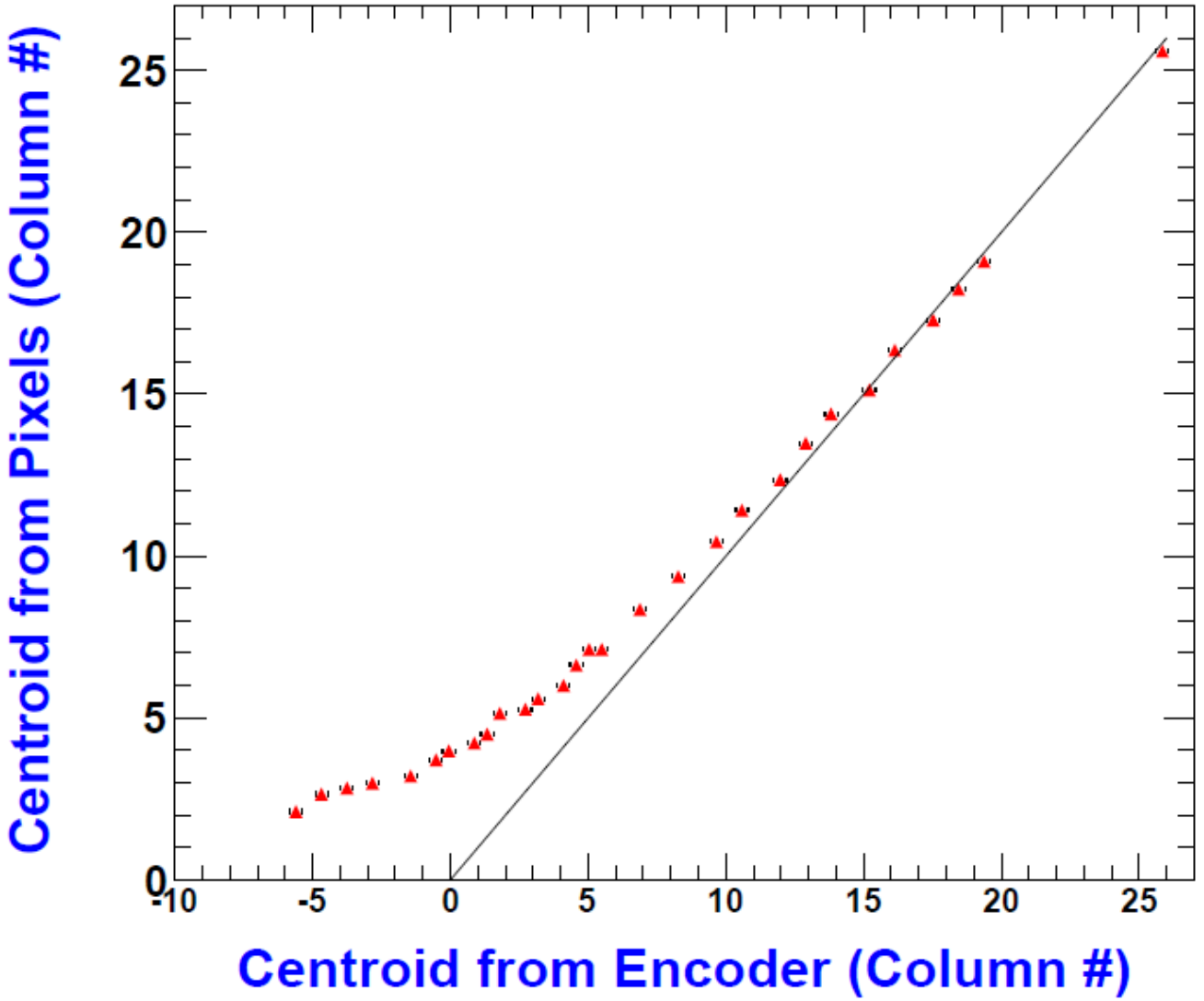
- **APS analysis underway...**

- **Having 9 dead pixels is understood, 6 extra pixels in serial register, and Leach says other 3 are from the electronics pipeline. (latest CCD has 10 dead?)**

4 pixel shift is global, due to extra 4 “prescan” pixels, easily flagged by glowing edge

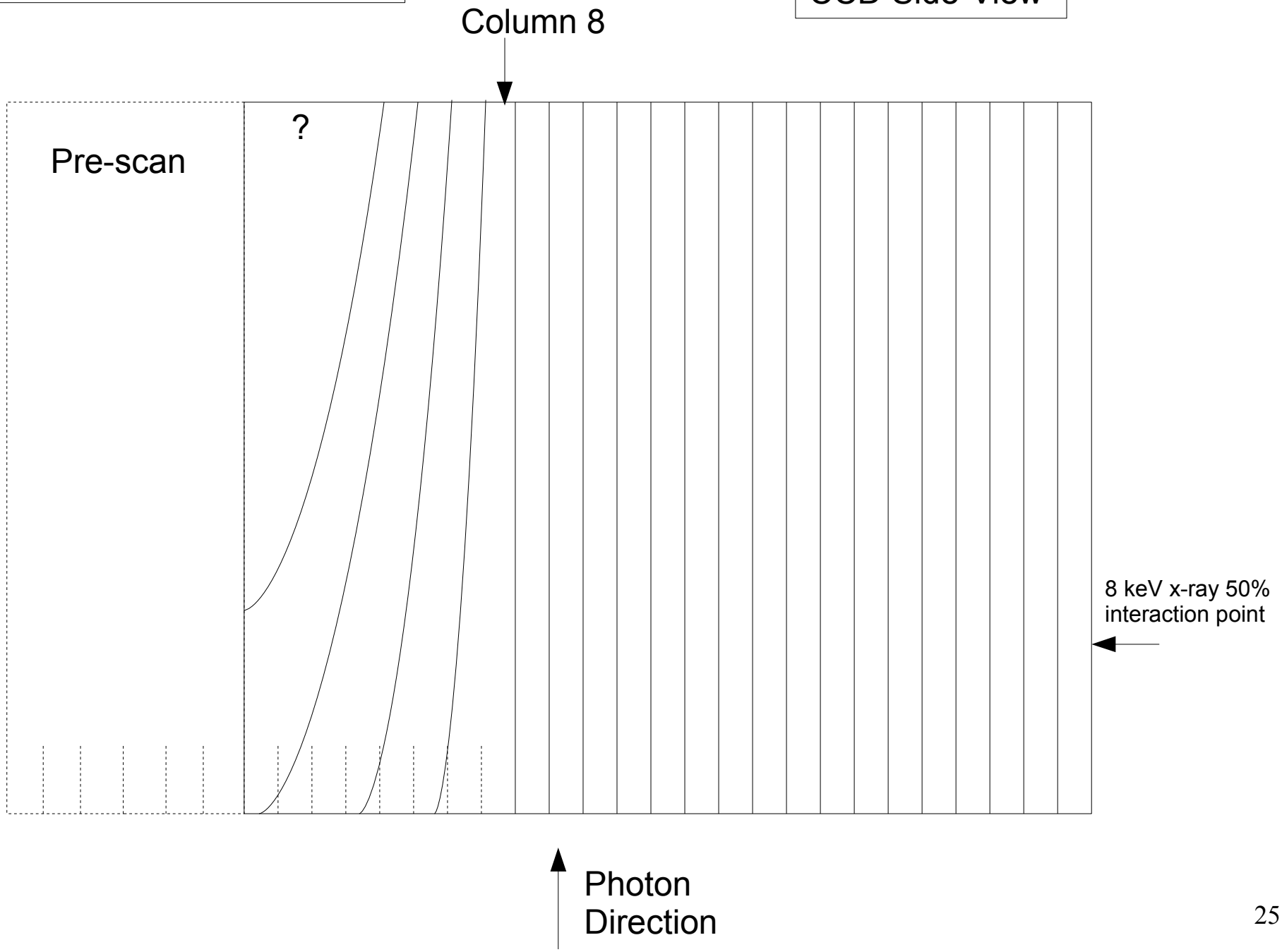


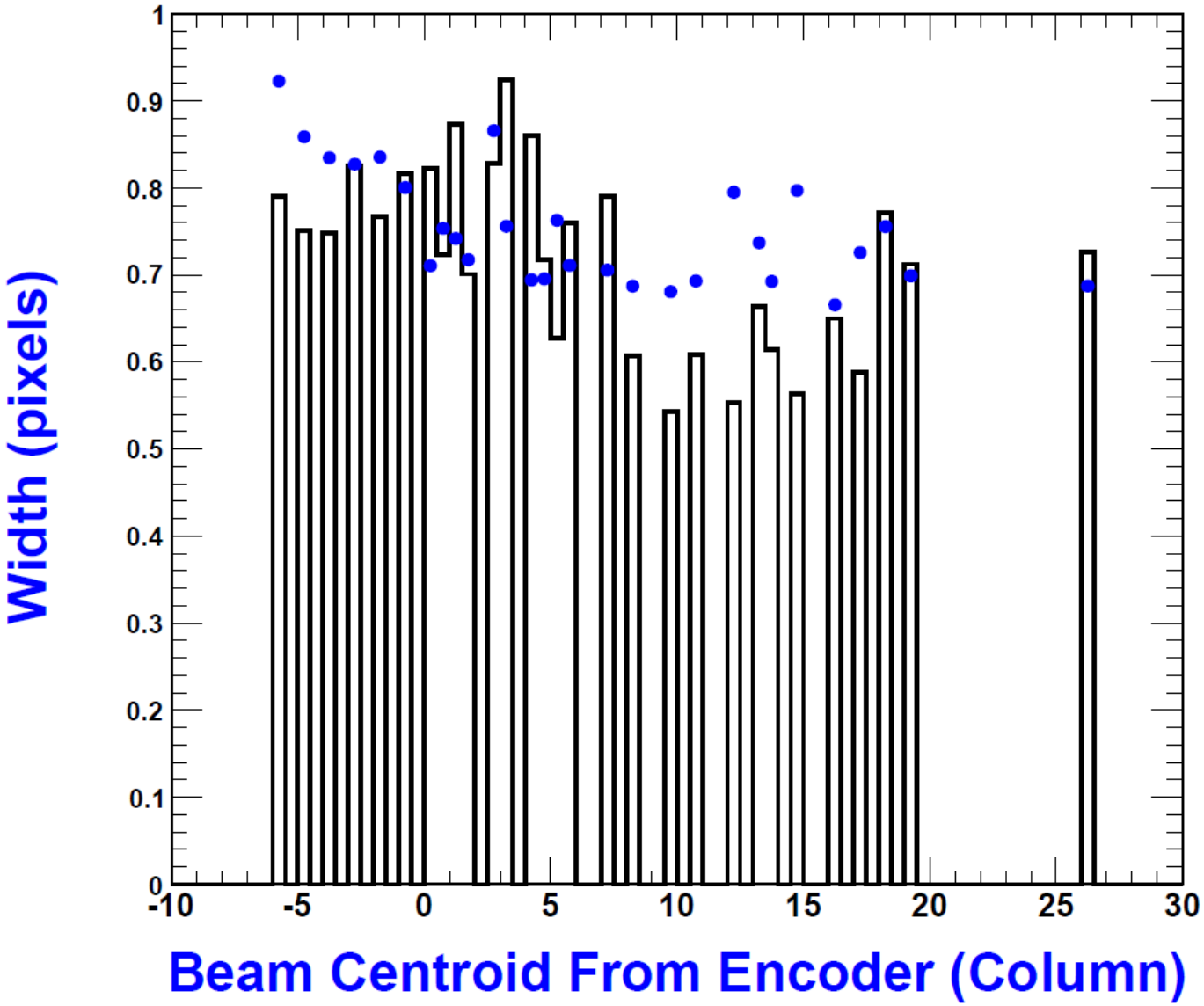
Growing effective pixel size at edge, opposite of what we saw in front-illuminated

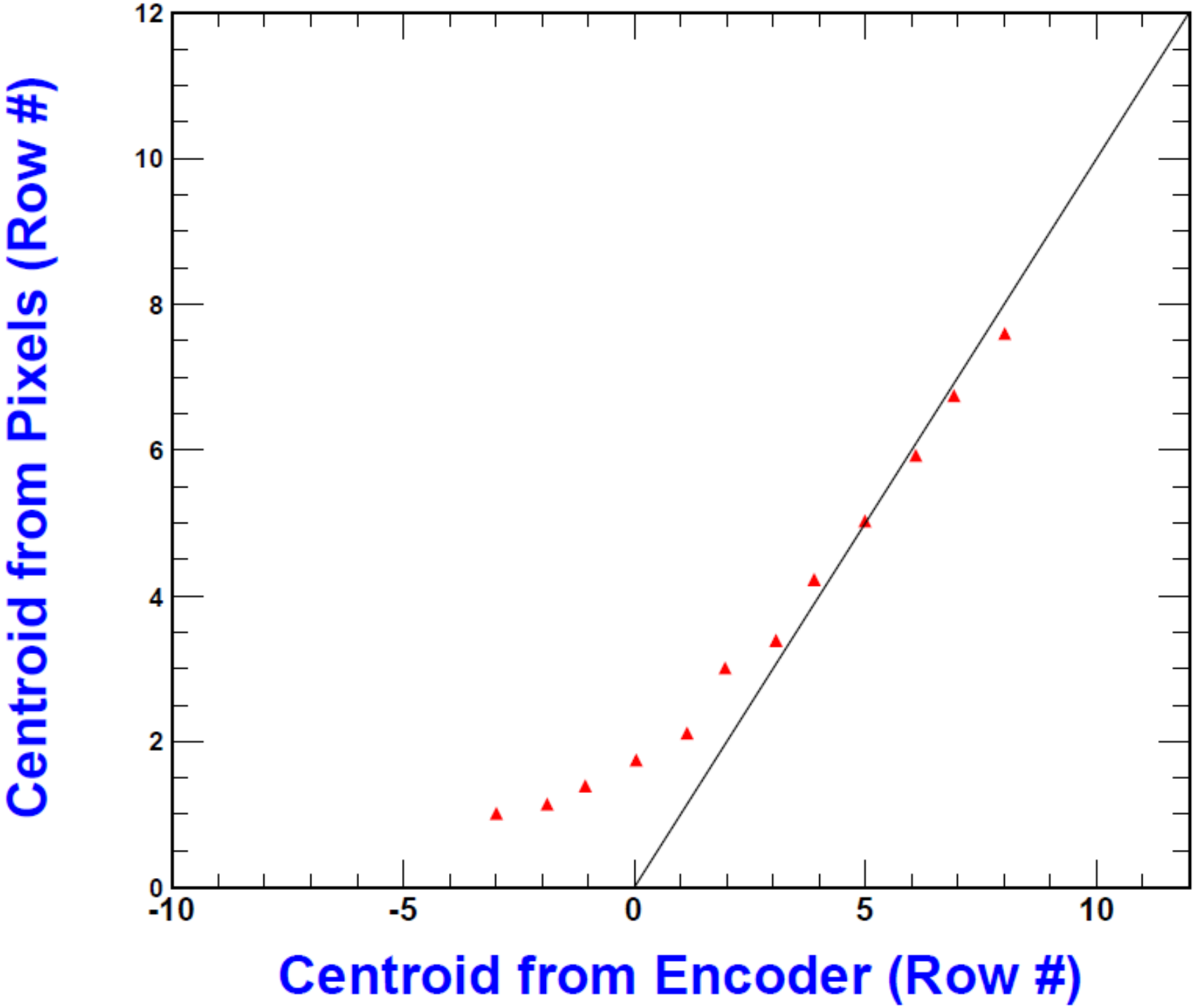


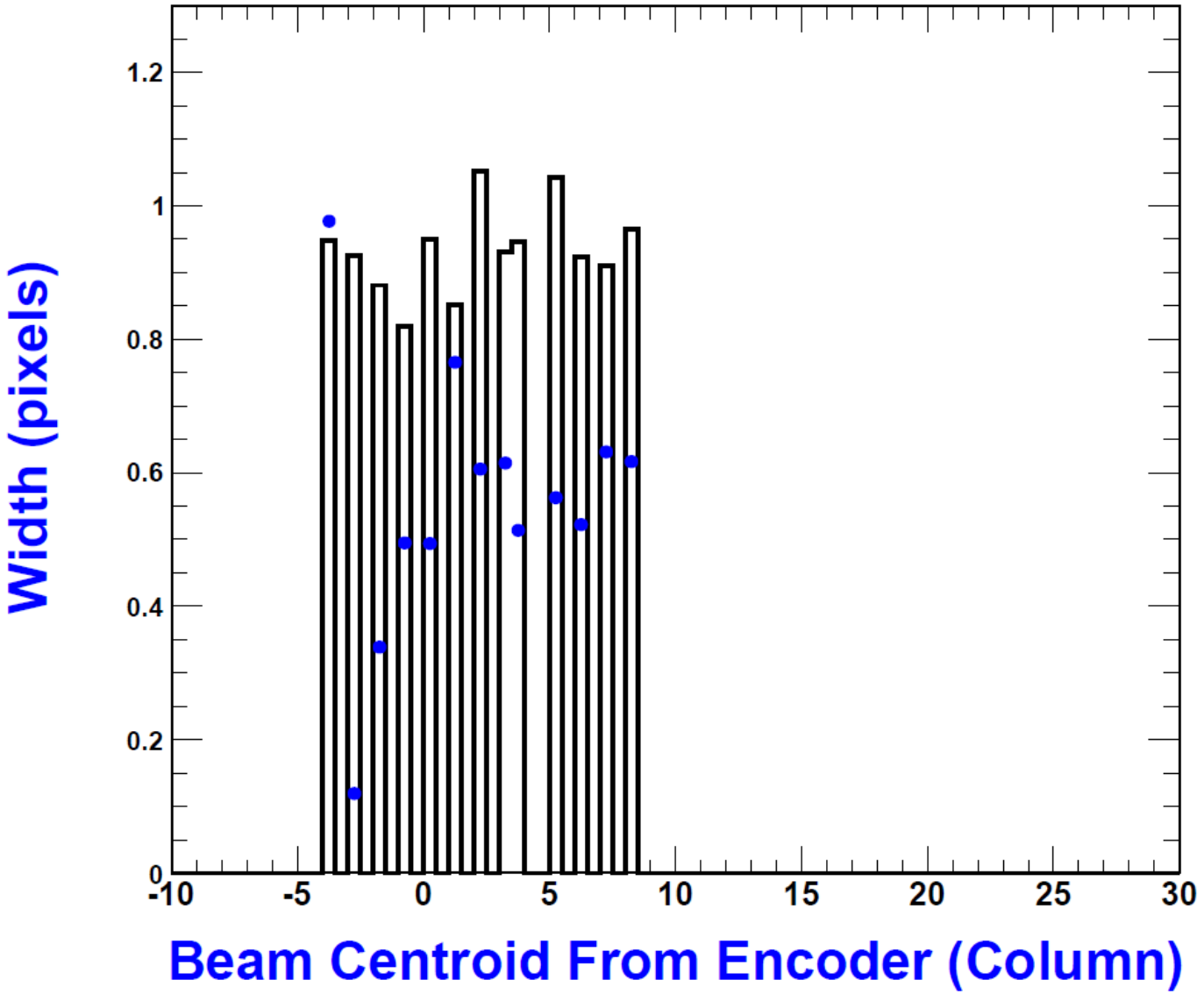
E-field model can explain columns >4 ok, but not <=4

CCD Side-View




Width (pixels)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-10
-5
0
5
10
15
20
25
30
Beam Centroid From Encoder (Column)

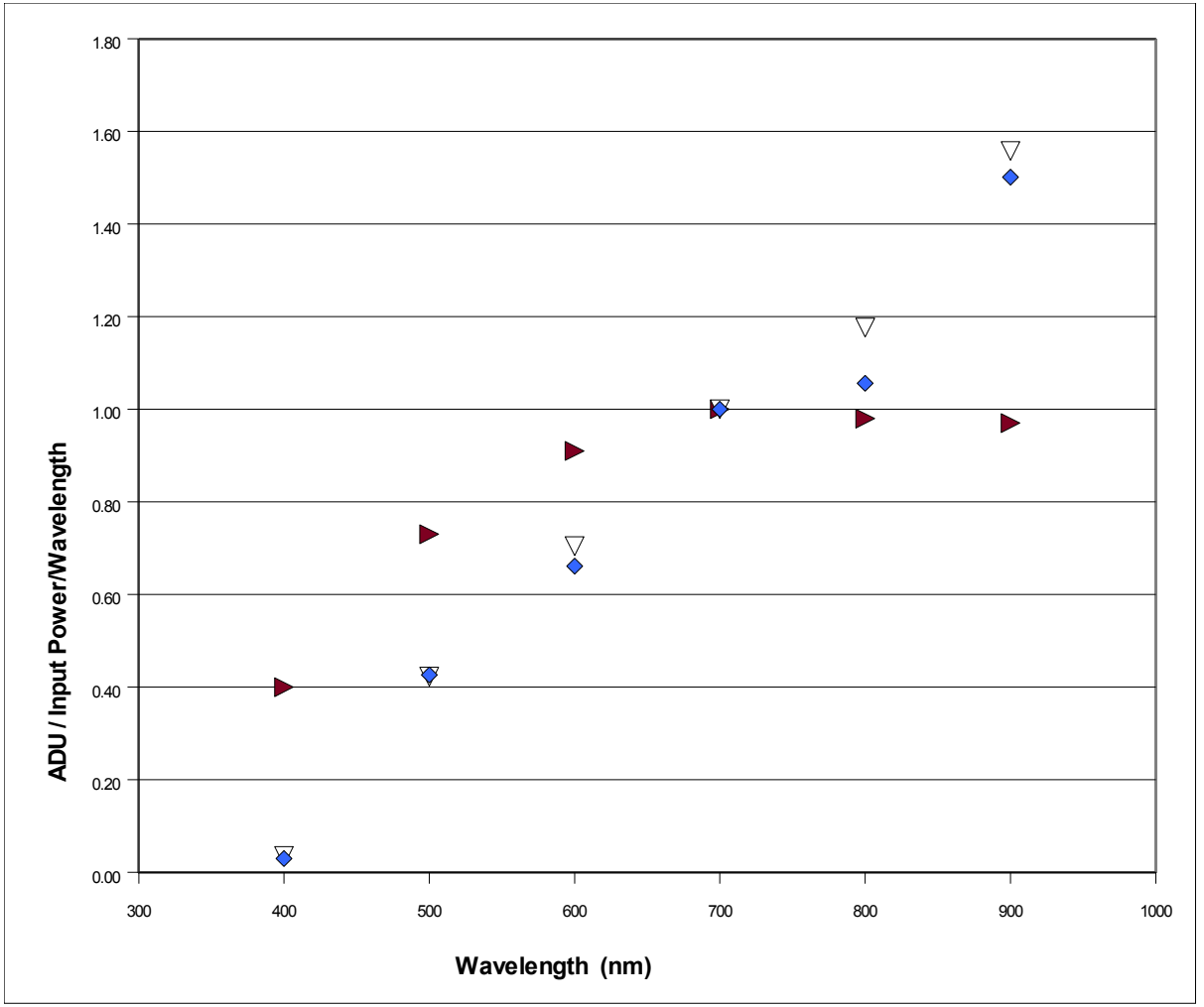

Centroid from Pixels (Row #)
Centroid from Encoder (Row #)
12
10
8
6
4
2
0
-10
-5
0
5
10

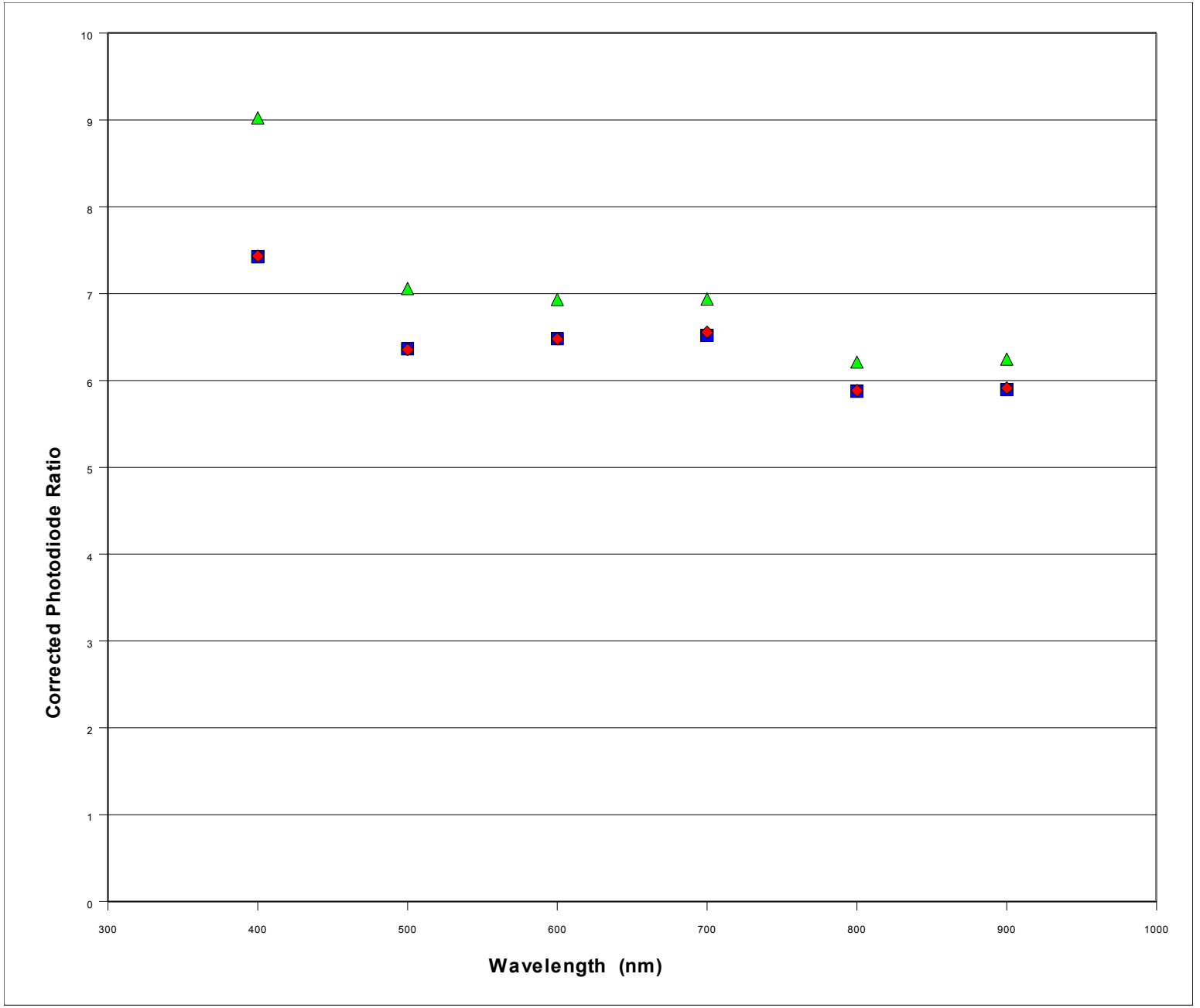

Width (pixels)
1.2
1
0.8
0.6
0.4
0.2
0
-10
-5
0
5
10
15
20
25
30
Beam Centroid From Encoder (Column)

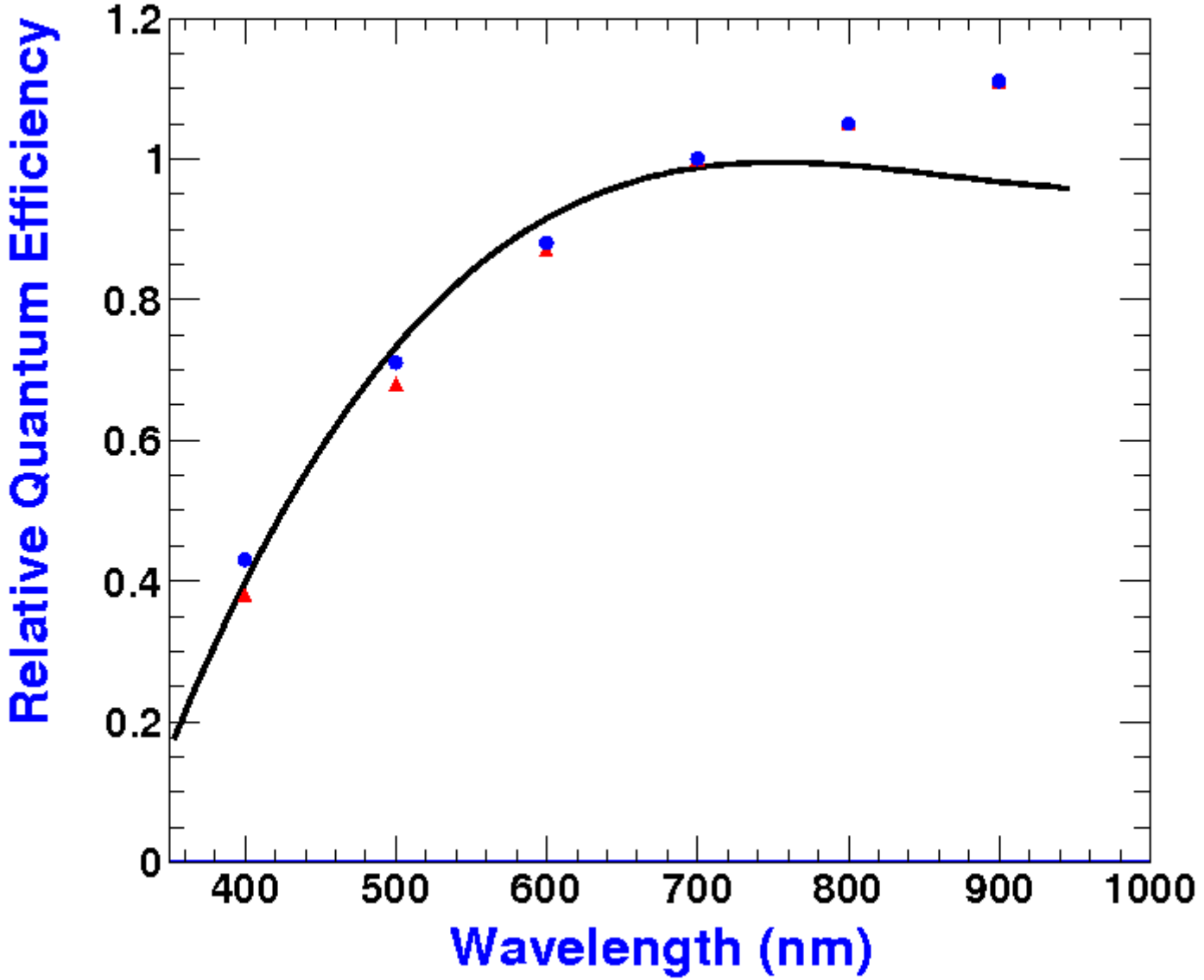
CCD Quantum Efficiency Tests in HEP

- Front vs back-illuminated
- Hal's tests of integrating sphere throughput
- Hal's tests of monochromator passing “higher orders”

Juan says that front-illuminated QE is supposed to look like open triangles (which we measured), and very different than back-illuminated



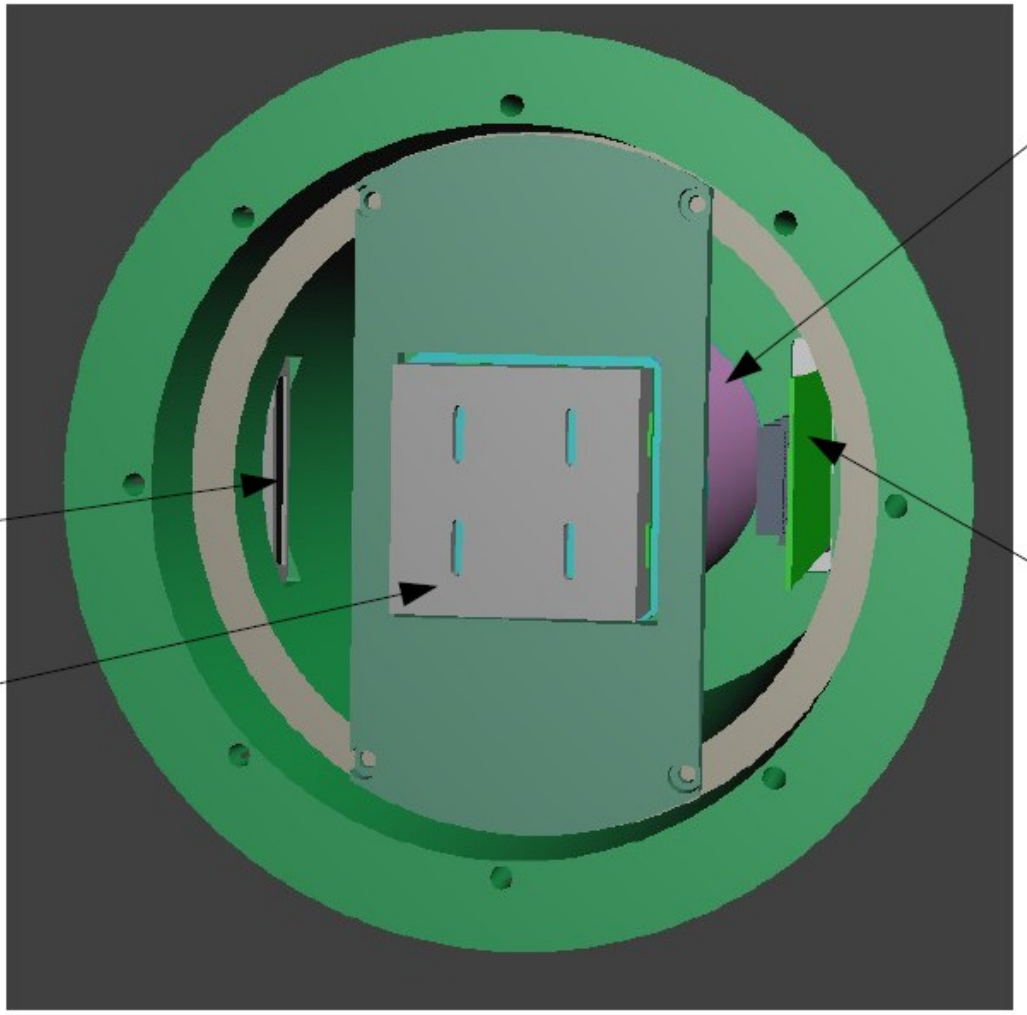

Corrected Photodiode Ratio
0
1
2
3
4
5
6
7
8
9
10
300
400
500
600
700
800
900
1000
Wavelength (nm)


Relative Quantum Efficiency
1.2
1
0.8
0.6
0.4
0.2
0
400
500
600
700
800
900
1000
Wavelength (nm)

backup

Precam dewar initial design

Vic Guarino (ANL), with input from Joe Bernstein, Herman Cease, Greg Derylo, Juan Estrada, Brook Gregory, ... has an initial 4-CCD dewar design.



CCD TODO Rest of 2009...

- Writeup Edge Effects in journal article (need more data? Depends on LBL reaction to draft)

- Meet with APS group on future work, new ~50-100 um pinhole on moving stand instead of slits (+ 5um pinhole)? Goal easy to achieve <=10um beam.

- Test new pinhole setup with Weizeorick FastCCD or APS PMT (rates only) or both

- Get new front-illuminated CCD from FNAL

- HEP teststand: QE mystery, DES overflow, modify focal plane for science packages, rest of FNAL testing procedure

- Precam

Precam dewar initial design

Plan:

1) Discuss more with experts
(for example, 0.5” clearance for CCD cables to make 90 degree bend?)

2) Make the focal plate in March and test it in current ANL dewars

3) Build the dewar this summer independent of precam decision (already funded for FY09)

4) Take to CTIO in December as part I of phased approach? (if Precam approved...)